Wisconsin Geological
and Natural History Survey

I. C. 6351

OCTOBER, 1930

DEPARTMENT OF COMMERCE

UNITED STATES BUREAU OF MINES
SCOTT TURNER, DIRECTOR

INFORMATION CIRCULAR

SAFETY AT THE MORENCI BRANCH OF THE PHELPS DODGE CORPORATION.

MORENCI, ARIZ.

BY

R. I. C. MANNING AND THOMAS SOULE

I.C.6351
October, 1930.

INFORMATION CIRCULAR

DEPARTMENT OF COMMERCE - BUREAU OF MINES

SAFETY AT THE MORENCI BRANCH
OF THE
PHELPS DODGE CORPORATION[1]

MORENCI, ARIZ.

By R. I. C. Manning[2] and Thomas Soule[3]

The Phelps Dodge Corporation considers safety a major operating problem, both from the humanitarian standpoint, for this company has a real interest in the welfare of its employees, and from the economic standpoint, for it has found the safe way to be the most economical. In turn, a feeling among employees that the company really has their interests at heart has a wonderful psychological effect. It is bound to bring forth more and better work and to attract and keep workmen of the better class.

There is keen competition between the various branches of this corporation for a trophy that is awarded each year to the one having the best accident record. This trophy was won by the Nacozari branch of the Moctezuma Copper Co. in Mexico in 1926 and 1927, and the Morenci branch won the trophy in 1928 and 1929.

MORENCI BRANCH

The Morenci branch consists of a mine, mill, and smelter, together with various shops necessary for the making and maintenance of equipment.

The mine is opened by three shafts, the Joy, Liverpool, and No. 6. Men can be taken into and out of the mine in case of an emergency through the three shafts, an inclined manway, and a drainage tunnel connecting with the bottom of No. 6 shaft.[4]

The block-caving system of mining is used.

---

[1] The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from U.S.Bureau of Mines Information Circular 6351."

[2] Associate mining engineer, U. S. Bureau of Mines.

[3] Mine safety inspector, Morenci branch, Phelps Dodge Corporation, Morenci, Ariz.

[4] For complete description of mining method see Mosier, McHenry, and Sherman, Gerald, Mining Practice at Morenci Branch, Phelps Dodge Corporation, Morenci, Ariz. Inf. Cir. 6107, Bureau of Mines, 1929, 33 pp.

Attitude Toward Safety

Every employee, from the manager down, considers safety an integral part of the operating activities of the mine. The safest way is considered the best and only practical way to do a job, and consideration is given to safety before any work is done. This is the attitude in starting any new project, as well as on routine employment.

Starting with the idea that the majority of accidents can be eliminated by proper supervision the management has seen to it that every boss is an enthusiastic booster of "Safety first." He is potentially a safety inspector of his division. Workmen can best be reached by the men who are in daily contact with them. Men feel that they have the cooperation of the shift bosses and foreman, who in turn know that the management is behind them. Close supervision, one boss to approximately 15 men, has helped greatly in "putting this work across" so efficiently.

Local operating officials know that the management is in earnest when it says that accident prevention comes first and is as important as getting out the ore. It is considered that work well planned will be done in the safest manner and that safety and efficiency go hand in hand.

Meetings, literature, safety bonuses, competition, and education are used as effective means by the company to impress the ideas of safety on the officials. Special talks are given by bosses and men on prearranged subjects, and each employee is made to feel that he is an integral part of the meeting. Bonuses are also considered an effective means of creating a greater incentive to safer work.

Each employee is taught that everything must be done in a safe manner, and that safety must not be sacrificed for speed or efficiency. Work is so planned that nothing interferes with this standard.

SAFETY ORGANIZATION

Safety Engineer

The branch safety engineer reports directly to the manager, and his principal duties are general safety of the entire branch. One day each week is spent in the mine on inspections. Special work, such as the erection of headframes, etc., comes under his supervision as to safety. He meets with the mine department safety committee twice a month and assists in this work in every way possible.

Mine Safety Inspector

The mine safety inspector devotes his entire time to work pertaining directly to the mine, with the exception that he superintends the instruction of all new men entering the employ of this branch of the corporation. Attendance at all committee meetings of the mine department, where he acts as secretary, and the conducting of workmen's safety meetings constitute some of his duties. In addition, general inspections and trips with inspection committees are so arranged that the entire mine is covered every two weeks. He has charge of the mine rescue stations and of first-aid training. Experiments with safety equipment are made or watched by the safety inspector.

All men entering the employment of this branch of the corporation, regardless of their official capacity or type of occupation, are trained and examined on first aid and various phases of safe work, as well as on standard methods of working as practiced by this company.

A list of questions comprising an examination that must be passed by all new men before starting to work is included in the appendix.

Once each year all men are reexamined on the safety rules and safe practices. The reexamination for 1930 is given in the appendix.

Committees

All safety work is brought up before a committee for discussion. Each branch and division has its committee.

Corporation Committee:

Chairman: P. G. Beckett, vice president and general manager in charge of operations.

Members: Branch managers.

This committee meets quarterly. The meetings are held at the various branches in order. (Bisbee, Globe, and Morenci, Ariz., and Nacozari, Old Mexico, and Dawson, N. Mex.)

Branch Committee:

Chairman: Branch manager.

Members: Heads of departments.

This committee meets once a month in the manager's office, and discusses the general safety work and means of obtaining the fullest cooperation of the various departments to prevent accidents.

Department Committee:

Chairman: Department head.

Members: Division heads.

This committee meets twice a month in the department head's office, and constitutes the board of control for that department. All accidents are reviewed, whether or not they caused lost time. Discussions are invited, and the best ways of eliminating similar occurrences in the future are discussed. Various safe methods of working are also brought up at these meetings.

Division Committees:

The mine is divided into eight divisions. All of the bosses and all of the men in each division constitute a committee of the whole, and their meetings are called the workmen's safety meetings. Every committee meets once every two weeks. The department head, bosses, and mine safety inspector also attend. The mine safety inspector acts as chairman and secretary of these meetings. The meetings last one-half hour and are held strictly to that time limit.

The first 15 minutes of the meeting are devoted to showing a one-reel film, usually containing a safety thought or idea, or it may have to do with education, health, Americanization, or pure entertainment. These films are procured free of charge from the Y.M.C.A. and are projected on the screen by means of a portable motor-driven projector.

The remaining 15 minutes are used for short talks by the bosses, mine safety inspector, or some of the men. Discussion of the various phases of the work is invited from the men, and some very interesting and valuable pointers have been received this way. As these meetings are always preceded by an inspection of this group's particular working place there is always something to bring up.

Cigars and cigarettes are distributed to the men at the beginning of the meeting.

Every boss and workman in a division is expected to attend unless excused by his superior, and the bosses check the men as they arrive at the meeting.

An English-Spanish interpreter attends all meetings so that everything can be satisfactorily explained to everyone present.

Prior to these meetings inspections are made by the mine safety inspector and a workman from that particular division, often accompanied by the division foreman. A different workman serves each time. This man keeps notes on his observations of infractions of the rules, faulty practices, faulty equipment, poor housekeeping, and safety suggestions; his notes, together with those of the mine safety inspector, are compiled in a report, which is presented to the mine superintendent for his approval and copies are distributed to every member of the supervisory force in that division. All suggestions must then be acted upon as soon as possible, and not later than the next two-week inspection. Thus, there are always a number of men in the mine who are trained inspectors.

Fire Meetings

Group meetings are held once every six months for bosses to discuss fire hazards, means of getting men out of the mine in case of a disaster, and ways of extinguishing fires. The meeting is usually presided over by the ventilation foreman who has charge of ventilation, fire lines, extinguishers, and stoppings. The mine fire council meets every three months.

Careless Workman's Committee

Members

Mine superintendent.
Assistant mine superintendent.
Division foreman (from defendant's division).
Mine safety inspector.

Habitually careless workmen, whether their actions have caused accidents or not, are brought before this committee, which considers their cases and decides what action should be taken. This committee keeps a record of each man's appearance before it. A copy of this record goes to the employment office in case he should seek a transfer.

Foreman Training Conferences

From time to time foreman training conferences are held to encourage these men to think analytically and to effect better cooperation, thereby increasing safety and reducing costs.

Bonuses

The mine supervisory force, including division foremen, shift bosses, drill-shop foreman, mechanical foreman, blacksmith-shop foreman, and engineer in charge of the chute checkers, is paid an accident bonus.

The mine foreman receives a monthly bonus, provided every man under his supervision has successfully passed that period without a lost-time accident.

The bonuses for other bosses vary according to the number of 1,000 shifts worked by men under their supervision without lost time accidents. The rates are as follows: First 1,000 shifts, $10.00; second 1,000 shifts, $17.50; third 1,000 shifts, $25.00. These 1,000-shift periods have to run consecutively for a boss to receive a bonus above $10.00. When a lost-time accident occurs the boss has to start over in regard to bonus, and receives $10.00 for the first 1,000 shifts worked. A lost-time accident is one in which the injured workman does not return to work the following shift; a lost-time accident is also counted when a man is kept on light duty or other work different from that on which he was injured for more than three days.

Awards and Prizes

Upon the completion of 90 consecutive working days without a lost-time accident in the mining department some entertainment is given for the employees and their families. Prizes, such as knives, key rings, match boxes, etc. are often given as awards. The company sponsors the entertainment, usually consisting of a show with local talent or a moving picture show. Tickets are issued, and every employee in the department receives a ticket for himself and one for each member of his family.

Safety dinners are given several times a year at irregular intervals for bosses. At these dinners talks are given by various officials.

Three delegates were sent by the Morenci branch to the National Safety Conference in New York in October, 1929. Papers covering their impressions of this conference were written by the members of this delegation.

EDUCATIONAL WORK

Safety posters from national organizations are posted conspicuously on bulletin boards at various places on the surface. These posters are attractively displayed and changed weekly.

The safety department owns a portable moving-picture projector, which is used to show 1-reel films portraying some particular phase of safety or educational work, not necessarily pertaining to mining. This film is shown at all division workman's safety meetings, and consumes about 15 minutes of the 30 minutes allotted to the meeting. The pictures shown are procured free of charge from the Young Men's Christian Association's Bureau of Moving Pictures, 300 West Adams Street, Chicago, Ill. This Bureau obtains its films from various manufacturing concerns. Metal-mining pictures are not usually shown, as some that have been sent to Morenci to date have depicted some particular phase of mining which is a direct violation of one or more safety rules at present in force. The pictures shown are usually entertaining as well as educational.

Companies showing pictures from the Young Men's Christian Association merely have to guarantee their return in good condition and pay transportation charges.

New men, after being hired by the company, report to the safety department immediately at the mine safety inspector's office. Before starting to work they must pass an examination on the safety rules of the company. The examination is identical for all men regardless of their proposed place. A 100 per cent grade must be made before a new employee is placed on the payroll.

To expedite the passing of this examination the company furnishes two instructors, under the supervision of the mine safety inspector, who assist new men in every way possible. This course of preparation for the examination consists of an illustrated lecture - models, moving pictures, and slides being used - a study of safety rules and standard practices, and first-aid instruction. The last named does not have to be finished before starting to work as it takes six lessons lasting one-half hour each on six consecutive days. This must be completed the first six days of work. An outline of the first-aid course is given in the appendix.

At the employment office each man is given a book containing the safety rules of the company. This book is of a size that may be conveniently carried in the pocket, has a substantial binding, and contains 37 pages.

The contents of this book are: A foreword by the manager stating the general policy of the company; 7 special rules, the violation of which means instant dismissal, 43 general rules, and numerous other rules for special work, together with penalties for their violation sectionalized under the following headings in order:

1. Timbermen and Timbering.
2. Miners and Mining.
3. Work in Raises.
4. Handling Explosives and Blasting.
5. Muckers and Hand Trammers.
6. Mine Transportation.
7. Hoisting Engineers, Cagers, Skipmen, Shaftmen, and others when in or about shafts, including the code of signals.
8. Repairing Shafts and Equipment.
9. Inspection of Hoisting Equipment by Head Shaftman in Addition to the Daily Inspection by Hoisting Engineer.
10. Mine Mechanical Work.
11. Operating Oxweld Cutting Equipment.
12. Underground Fires.

The seven special rules, violation of any of which results in instant dismissal, read as follows:

1. Do not blast unless you are sure that all approaches to the place are guarded to prevent anyone from getting near the blast.
2. Do no unnecessary work after spitting the fuse.
3. Unless firing electrically do not return to your working place for thirty minutes after blasting and don't allow anyone else to do so.
4. Mis-fires must be blasted before any more work is done in the working breast.
5. Use only a wooden tamping stick when charging holes for blasting.
6. No one shall start a fight on or around the works.
7. Men must not report for duty under the influence of intoxicating liquor.

All men are required to pass a 100 per cent examination on this book. Instructors are assigned to men who are unable to read. The last page is perforated, and consists of a receipt which signifies the employee's intention to abide by the rules contained therein. This receipt is signed by the employee to whom issued and the person issuing it. It is then detached and forwarded to the mine superintendent's office where a check is made to see that each man has received a book. All bosses and men are reexamined yearly on these rules, the examination being conducted by the mine safety inspector or someone designated by him. The reexamination consists of 60 questions, and covers rules and regulations that have been put in practice since the rule book was published. A copy of these questions is in the appendix. Besides this reexamination, the bosses are required to demonstrate the correct use of the all-service gas mask and the oxygen inhaler.

Most new men pass the first test, but should they fail they are given additional opportunities.

Penalties

The penalties for violating rules other than the special ones are as follows:

First offence:	Letter of warning.
Second offence:	10-day layoff.
Third offence:	Dismissal.

Ignorance of rules is not considered a valid excuse. In fact, it is a misdemeanor, for there is penalty for not knowing them.

All cases of violation are reviewed by the Careless Workman's Committee before any action is taken.

Physical and Mental Qualifications

In placing men at various jobs in the mines due consideration is given to their physical and mental fitness for the job. Some types of work require certain characteristics for their safe and economical performance. Grizzly work, especially, demands that the worker be constantly alert mentally for safe operation. Foremen make a written monthly report to the mine superintendent on the mental alertness of all men so employed.

New Men

A man applying for employment is first sent to the doctor for a medical examination. If he passes this successfully, the employment agent, who does all the hiring, gives him a copy of the company rules, as previously described, and tells him what he is expected to do. This agent also informs the applicant what he has to buy to equip himself properly for work.

After passing his examination on the company rules he is given a "Probation" time card marked with a "red circle." He will be given these cards until he completes his first-aid training, and thereafter until his shift boss and foreman are assured that he is suitable for the job to which he has been assigned. During this time the new man must work only with an experienced man. In no case will this special or "Probation" time card be issued for more than 15 days. As soon as the shift boss and foreman are assured that the new man is suited for the job for which he was hired they countersign the man's transfer and send it to the mine superintendent, after which the man receives a standard time card.

The first-aid classes are held on the employee's time, English classes being held from 3:30 to 4:00 P. M. and Spanish classes from 4:00 to 4:30, daily.

The day before going to work new men are provided with the following, which is compulsory:

Hard hat.
Safety shoes.
Goggles.
Respirator.
Spats (if working on grizzlies).
Carbide lamp.
Carbide can.
Matches in moisture-proof container.

Special equipment is furnished, such as wrenches, tool sacks, powder sacks, fuse wrappers, foot protectors, etc., if needed, before the man goes to work.

An employee of the safety department, stationed at the collar of the shaft when the day shift goes on, is instructed not to allow any man to enter the mine unless provided with the above equipment.

The company charges for safety shoes and lamp at cost, and one-half price for the hard hat. Credit for these may be obtained and deducted from the first pay check. All of the other compulsory equipment is furnished free, as are replacements once every three months.

The wearing of loose or unnecessary clothing is discouraged.

All men are requested to carry watches.

All men performing work where flying particles are likely to get into the eye are required to use goggles. Men doing the following work must wear them:

1. Starting to drill a hole.
2. Drilling hitches in rock.
3. Breaking rock.
4. Picking.
5. Barring down loose rock.
6. Blowing out holes.
7. Loading holes sharply inclined upward.
8. Pulling chutes.
9. Operating a motor train.
10. Removing dusty timbers.

Standardization of Work

As far as possible all work is standardized, including timbering, blasting, haulage, stope, and development work. This standardization is in effect throughout the entire mine, so that if a man should be transferred to another section he would have identical working conditions as far as possible.

If a boss is going to be a teacher he must have a text book. Such a text book has been prepared at Morenci for use of all members of the supervisory staff. It is called "A Text Book on Safe Methods of Mining." This book contains the best accepted standard practices and is used by the supervisory staff in instructing their men in the safe and practical method of doing their work. It is not assumed that this book is the "last word" in mining practice at Morenci, but it does describe accurately the best known safe way of doing all jobs at the time it was issued. It is a loose-leaf book which is revised from time to time as changing conditions warrant. The material for this book was secured through the cooperation of all members of the supervisory staff; thus, it is a compilation of the best methods, drawn from the experiences of those who are using it.

The following is an example of equipment furnished and instructions given to men working on grizzlies, and is an example of one page from the text book on safe methods of mining:

In addition to the aforementioned equipment, all new men receive the following:

1. Eight-pound hammer with one end drawn to a pick point.
2. Pointed bar not longer than 6 feet.
3. Draw hook to turn rocks over without using hands.
4. Pick and shovel.
5. Safety belt with rope attached.

New men are reinstructed by the shift boss on the following:

1. To use goggles when sledging.
2. To use standard equipment properly.
3. Not to work one finger raise when the opposite one is hung up.
4. Not to work without safety belt and rope attached.
5. How to place detonator for making primer.
6. How to prepare an explosive charge for placing on a stick for blasting "hung up" raises.
7. How to operate blasting signals to notify workmen on the haulage level below.
8. How to blast.

SAFETY DEVICES IN THE MINE

Standard Practices

All blueprints and drawings for work to be done are examined for safety and approved by the mine superintendent and head of the department. As previously stated, all classes of work are standardized as far as is possible.

Many safeguards or devices have been installed in this mine as standard equipment, most of which are foreign to other mines. The most outstanding of these are:

Blasting

All blasting in the mine is done electrically, using 250 volts direct current. After the holes are loaded, the detonator wires are connected to the lead wires, which are then strung from the face to a connection on the main blasting line. This connection must be in a safe place out of direct line of fire from the face. Between this connection and the source of power are interrupter and main firing switches. Blasting is done twice daily after all men have been removed and checked from the working places. The Morenci mines have standardized on electric blasting 100 per cent on all operations underground. Before a boss can take charge of a group of men he must give an actual demonstration of the safe standard method of electric blasting in the presence of a member of the safety department and his foreman. Before miners can fire electrically they also have to put on a like demonstration.

Timbering

Considerable study has been given to the planning of the most economical and the safest way of framing and placing timber sets for drifts, chutes, raises, grizzlies, etc. All this work is now standardized, and every installation must conform to these standards.

Shafts

Work in and around shafts has been made as safe as possible, and several noteworthy safety features have been installed such as:

Sprinkling system to combat shaft fires.

Counterbalanced hoisting in the Joy shaft where men and materials are transported.

Operation of the hoist from the cage in the above shaft, the cage being essentially similar to an elevator in an office building.

Derails placed 30 feet from the shaft on each level.

Heavy rail welded to each of the above gates to prevent cars or motors from getting into the shaft in case they pass the derail.

Chains to prevent men from crowding against shaft gate at the end of the shift.

Safety Belts

Safety belts and ropes are used at all grizzlies and pockets; also wherever there is danger of a man falling when working.

The safety belt and rope are to keep the man from falling through the grizzly and to keep him from standing directly in the path of falling rock. The rope must be short enough so that he can not step on the middle bar of the grizzly.

At the pockets the ropes are fastened by means of a ring to a steel cable stretched parallel to the pocket, so that the ring will readily slide along the cable.

Covering Grizzlies

Grizzlies are kept covered at all times except when passing rock through them. The standard cover is two 3" x 12" x 6' 0" sound planks laid side by side.

Chain Hand Hold

As additional precaution against falling through grizzlies there is a chain hand hold over each.

Drilling

All drilling in the mine is done wet. A guard is secured to the stoper drill in such a manner as to prevent rocks from falling on the hand.

Respiratory Devices

Gas masks are stored underground in the foremen's offices. Self-rescuers, 100 in all, are stored underground at strategic points. These are kept in cases, together with candles. All men and bosses are thoroughly trained in the use of self-rescuers and in their limitations underground.

First-Aid Material

Mine bosses carry pocket first-aid kits containing 12 adhesive patches and a vial of mercurochrome. Large first-aid cabinets are located at all shaft stations and other strategic points. The large cabinets contain the following material:

1	blanket.
1	hot pad.
	waste.
12	triangular bandages.
5	large compress bandages.
5	small compress bandages.
20	rolls gauze bandages.

- 1 tube Unguentine for burns.
- 6 muslin finger cots.
- 1 2-oz. bottle mercurochrome.
- 1 2-oz. bottle spirits ammonia.
- 1 square yard of plain gauze.

A report is made to the safety department of every scratch treated, telling briefly how the injury occurred. This is done on a small report card that fits in the pocket first-aid kit.

Trash Disposal

A large, specially constructed trash car is on each level. Trash cans are also located about the levels for carbide, etc.

Toilet Cars

Specially constructed toilet cars are kept at convenient points on all levels. These cars contain chemicals to prevent odors and to facilitate cleaning.

Manways

Ladders in manways are offset with platforms every 10 feet. At the top of all manways is a perforated-iron door that prevents objects from falling down the manway and that at the same time offers as little resistance to ventilation as possible.

Fire Prevention

Water lines for fire fighting are installed in all workings, especially in heavily timbered sections. A supply of 2-inch hose is also kept at strategic points underground. In addition to this an arrangement on the surface provides for turning water into the air line by opening a valve. There are also 63 soda acid fire extinguishers underground.

A stench system for warning miners in case of fire is attached to the air line.

Ventilation

The mine is well ventilated by natural and mechanical means. Three Sturtevant No. 12 fans, each of 100,000 cubic foot capacity, are exhausting at opposite sides of the mine. The ventilation is so arranged as to remove most of the dust and smoke without drawing it through other active workings.

Compressed air is blown for 1/2 hour in stopes, and from 1-1/2 to 2 hours in active development workings after blasting.

The mine is exceptionally well ventilated, and is kept relatively cool.

First-Aid and Mine Rescue Station

An up-to-date first-aid and mine rescue station is maintained on the surface. The building contains:

Mine safety inspector's office.
Demonstration room.
Humidor.
Lecture room.
Gas chamber.

The equipment consists of:

11	sets self-contained oxygen breathing apparatus.
11	all-service gas masks.
120	self-rescuers, (there are also 100 underground.)
2	inhalers
2	oxygen pumps
1	C O detector (hoolamite).
7	canaries
1	pyrotannic acid C O detector.
1	Orsat apparatus.
14	permissible flash lights.
1	life line.
1	complete apparatus for sampling dust in metal mines.

Reports of Accidents

All injuries, regardless of their apparent triviality, are reported. Bosses carry cards with perforated stubs on which they record accidents. The injured workman receives the stub with instructions to report to the first-aid station, and the boss deposits the card with the man's name and description of injury in a box at the mine safety inspector's office. At the first-aid station slight injuries are treated by trained attendants, and where an injury apparently requires the attention of a doctor, the man is sent to the doctor's office.

An accident report is necessary for every injury, whether the man is sent to the doctor or to the first-aid station, and regardless of whether time is lost or not. A committee, composed of the boss and three or four workmen, investigates every accident. The place where the accident occurred is inspected and a report made. The committee also makes recommendations for the prevention of similar accidents in the future.

A man reporting to the doctor must be released by him before returning to work. The man's boss sees that he reports to the doctor and gets his release before returning to work. If the injury is not serious enough to prevent working the man continues at his regular occupation but reports to the doctor at a time designated by the hospital clerk, who also notifies the mine superintendent.

The accident is considered by the assistant mine superintendent, foreman, and safety inspector, and classified as to primary cause. The final report is made out in triplicate, signed by the mine superintendent, and sent to the manager. All accident reports are studied by the manager, assistant manager, and branch safety engineer, and discussed at the next branch safety meeting.

First-Aid and Mine Rescue Training

In addition to the first-aid course given to all employees upon entering the employ of the company by the company instructors, a Bureau of Mines course in first aid is given annually by Bureau instructors. All the men at this plant recently completed a Bureau of Mines first-aid course. Thirty men were also trained in mine rescue.

Interest in first aid and mine rescue is stimulated by a local first-aid contest held every June. As many teams from the various departments as desire to enter the contest are encouraged to do so. Each member of the winning team receives $20.00; those of the second team, $15.00 each; those of the third team, $10.00 each; and all other members of participating teams are given $5.00 each. The company sends the winning team to the international meet each year.

The local contest is held in the plaza and is witnessed by most of the employees and their families. This demonstration is considered to act as a stimulus to first aid in the home and at work.

Mine rescue teams receive regular training at weekly intervals, and work out a problem monthly while wearing apparatus. The members of these teams are paid for their time while practicing.

The following tables show the accident rate and accident statistics for the Morenci branch of the Phelps Dodge Corporation from 1925 to 1929, inclusive:

Table 1. Accident Record, Morenci Branch, Phelps Dodge Corporation, Morenci, Ariz.[1]

	1929			1928			1927		1926		1925	
Department	No.	Total shifts	Per 1,000 shifts	No.	Total shifts	Per 1,000 shifts	No.	Per 1,000 shifts	No.	Per 1,000 shifts	No.	Per 1,000 shifts
Underground	3	200,815	.016	13	127,051	0.102	15	0.104	72	0.408	281	1.315
Concentrating	0	73,921	-	3	67,949	.044	-	-	7	.105	38	.529
Smelting	1	59,506	.017	-	62,184	-	5	.077	18	.277	36	.578
Mechanical and shops	1	53,223	.013	-	66,917	-	6	.098	12	.200	26	.794
Miscellaneous surface	1	26,460	.027	-	31,845	-	2	.063	5	.144	18	.387
All other	-	50,187	-	-	29,313	-	-	-	-	-	-	-
Total	6	464,112	.013	16	385,259	.042	28	.071	114	.264	399	.878

1/ This tabulation covers all fatalities and lost time accidents.

Table 2. Last Accidents

Department	Time without accidents	Total shifts worked	
		Present record	Best record
Smelter	October 23, 1929 to February 1, 1930; 101 days	16,940	146,473
Mechanical and shops	May 22, 1929 to February 1, 1930; 255 days	57,358	123,170
Miscellanous surface	December 21, 1929 to February 1, 1930; 41 days	3,929	71,137
Mine	October 30, 1929 to February 1, 1930; 93 days	56,449	103,573
Concentrator	November 19, 1929 to February 1, 1930; 1 year, 73 days	87,682	87,682
Total Branch	December 21, 1929 to February 1, 1930; 41 days	59,089	211,343

8090

Distribution of Reports and Other Information

Each member of the supervisory force has a mail boy, usually at the place where he eats lunch. Mail is distributed daily. All members of the supervisory force are kept informed of any new rules and regulations, given copies of inspection reports, and minutes of all safety meetings.

The following are some of the reports sent out:

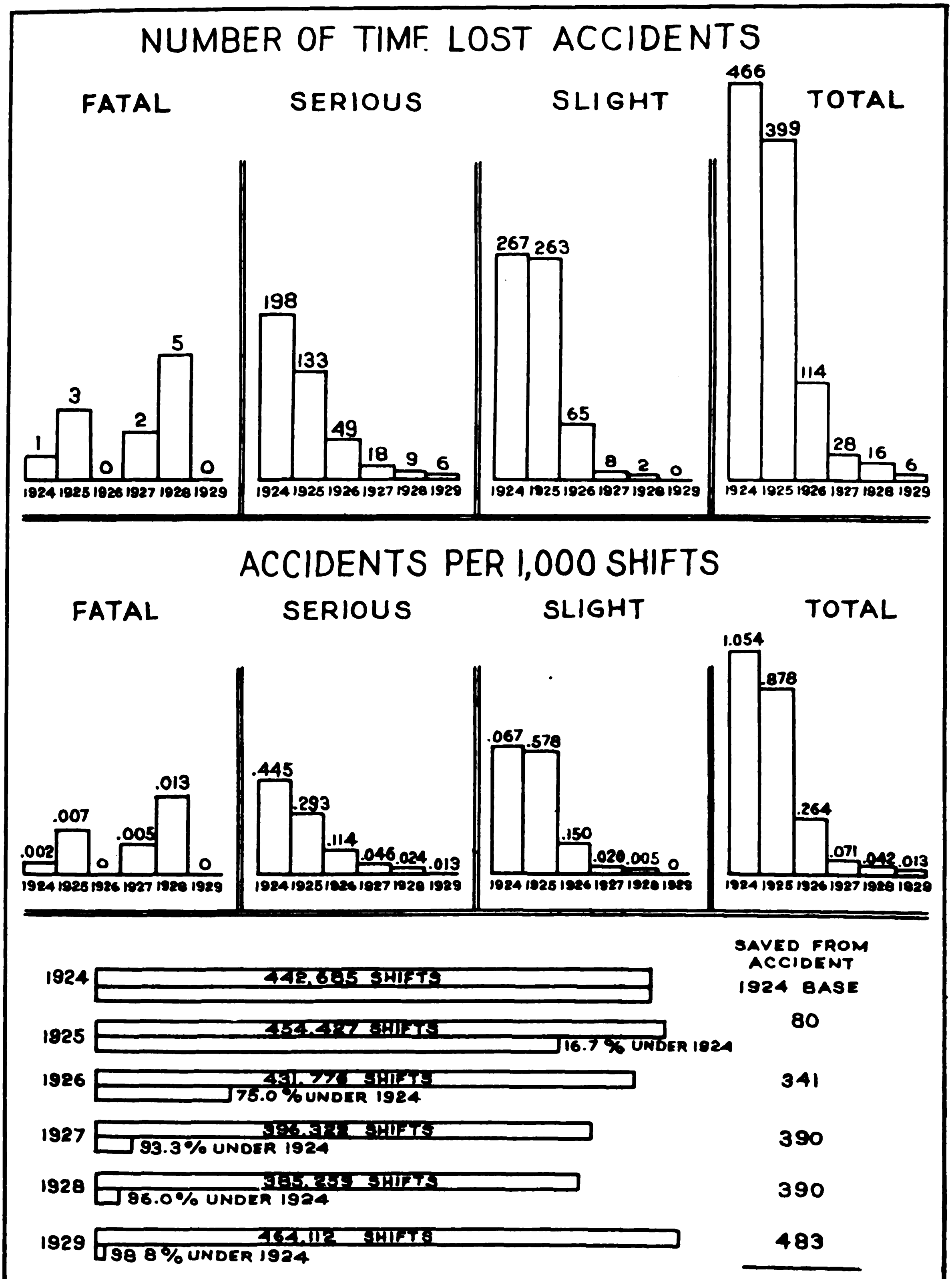
Report of workman's inspection committee.
Minutes of department safety committee.
Minutes of shift bosses' safety meeting.
Minutes of workmen's safety meetings.
Lessons previous month's accidents.
Reports on standardization.
Communications from manager, mine superintendent and other officials.
Reports of fire council meetings.
Miscellaneous reports and information.

All members of the supervisory force are informed in writing of all the above and are expected to get this information to their men at once.

CONCLUSIONS

The splendid accident record of the Morenci branch is due to a great many causes, the most prominent of which are listed below:

1. The management considers safety a major operating problem.
2. All members of supervisory force consider safety of primary importance, and are firm believers in the safety movement.
3. Standardization of all work in the mine.
4. Compulsory education in first-aid and safe-mining methods.
5. The adoption of safe equipment.
6. Compulsory wearing of protective clothing.
7. Electrical blasting throughout the mine.
8. Good working and living conditions.
9. Enthusiastic cooperation between mine departments.
10. Competitive spirit stimulated by first-aid contests held annually.
11. Prizes are offered for the best safety suggestion each month.



ACCIDENT DATA

PHELPS DODGE CORPORATION - MORENCI BRANCH

TABLE 3.

APPENDIX

Re-examination for 1930

1. Have you ever been examined on the mine safety rules contained in the mine rule book?
2. Are you familiar with all these rules?
3. What kind of powder is used for loading stoper holes?
4. What is the difference between hand moils and machine moils? How do you tell them apart?
5. Describe a standard trash can? Supply can?
6. What fire equipment is kept underground? What is the location of that nearest to your working place?
7. What is a self rescuer? When can it be used? Where are the ones nearest to you?
8. Why must miners work off of 10 ft. planks in a shrink?
9. What special precaution is taken when taking acetylene torches underground?
10. How are the handles of wheelbarrows protected?
11. How are shaft stations protected from runaway cars?
12. What is done with nails?
13. How do you recognize a blasting switch?
14. What kind of slings are used for lashing pulleys to stulls? How is the pulley secured to the sling?
15. What are the different kinds of sacks used underground? Describe the use of each.
16. What must you do with all scratches, cuts, splinters or any other injury?
17. Whose duty is it to clean up after a job is finished?
18. What does the State Law say about guarding openings?
19. What are the safety precautions in the use of hard hats?
20. When are foot protectors or spats used?
21. How are tamping boxes marked?
22. Should brakemen wear gloves? Who else should wear them?
23. When is the use of gauntlet gloves forbidden?
24. Describe the underground check out at the end of the shift.
25. How often is safety equipment inspected?
26. Can cars be pulled towards oneself by hand?
27. How high can steel be piled on steel trucks?
28. How does a brakeman call a motorman to a chute in case of an emergency?
29. Describe a chute bar. Give its use. Describe a point bar. Give its use.
30. Rule on riding skips or buckets.
31. Give rule for working on steep embankments.
32. Describe a standard sanitary drinking fountain.
33. How should oil, grease, waste or other inflammable material be stored underground?
34. What is done to abandoned drifts?
35. How should a cage door be before cage is moved?
36. How are the handles on stopers guarded?

37. When walkways are laid between rails, how should they be built?
38. What material should be used for center lines in drifts and raises?
39. Describe the proper way to load men into a cage. How far back from the station should they line up?
40. Whenever a hoistman leaves a hoist, what should he do?
41. How are pipe lines secured to timbers?
42. What should be done with a rope before it is used?
43. When should blacksmiths wear goggles?
44. Give location of air hose in a raise when blasting.
45. Of what must you be sure before sledging or drilling a rock?
46. What is the spacing of ladder rounds, when two ladders are joined?
47. What rules does a magazine keeper follow, when issuing powder and caps?
48. Under what condition can the same person transport powder and caps at the same time?
49. What is used for hooks for Jackhammers?
50 When are missed holes blasted?
51. What is done with spent carbide?
52. Should nails be used to open valves?
53. How can a safety rule be modified?
54. What kind of goggle frames are used for mechanics?
55. Should you drill off a muck pile?
56. When blasting electrically, where should the first connection be made, when coming from the face?
57. Do you know of any of our safety rules you cannot follow?
58. Have you any suggestions that will make for greater safety?

Phelps Dodge Corporation-Morencie Branch; General Rules

1. What is the policy of the Phelps Dodge Corporation, Morencie branch, in regard to safety?
2. Name the seven rules for which a person will be instantly dismissed, if they are violated.
3. Will careless persons be kept in the employ of the company?
4. If in doubt about the meaning of a rule, or if there are no written rules covering a particular piece of work what should you do?
5. If you notice any unsafe conditions what must you do?
6. What is your first duty when before starting work that might endanger others?
7. Under what conditions are visitors or strangers allowed underground?
8. When feeling sick or dizzy before going to work, what is the proper thing to do?
9. If for any reason you cannot report for work, what should you do?
10. What is the rule about lifting loads that are too heavy for one man?
11. What must you do at once, if you receive an injury no matter how slight?

12. What is the first thing to do, when starting machinery in motion, turning on compressed air or water and throwing in an electric switch?
13. What is first thing to do before starting work above or below other men?
14. How is trash disposed of underground?
15. With what safety clothing and equipment should men, in the mining department supply themselves?
16. How do you dispose of waste or spent carbide?
17. If in the course of your work, you discover defective equipment, what should you do with it?
18. Describe the difference between the hoistman's signal and the call bell.
19. What are safety stations and how do you recognize them when passing through the haulage level?
20. Under what condition can you pass around trains?
21. How should material be carried, when walking under trolley wires?
22. In case of breakdown in electrical equipment, what must you do?
23. What precautions must be taken, when piling materials on the level?
24. What do you do to protect yourself, when working in a dusty place?
25. When should goggles be worn?
26. What is done with projecting nails?
27. Penalty for violation of rules.

MINING RULES

28. Should defective timber ever be used?
29. Should timber be put in properly at all times?
30. What must you do before starting to timber?
31. How do you keep unframed collar braces in place?
32. In standing a post before the cap is in place, how would you support it?
33. Describe a staging built in a set of timber?
34. How would you protect men working ahead of the last set in bad ground?
35. Why should you have a clear passage from the working face at all times?
36. Why is good house keeping necessary?
37. Describe the method of handling materials and tools in manways?
38. How far should ladders extend above platforms?
39. What would you do to prevent men from walking into open holes or chutes?
40. How would you protect yourself, when working in or around any opening?
41. How would you protect yourself, when working around trolley wires.
42. What must you do when working inside of an open raise?
43. Who is directly responsible for the condition of your working place in reference to safety?
44. If you sound your roof at the beginning of the shift is that sufficient?

45. What do you use to bar down and how do you stand?
46. Why do you examine the working face after blasting?
47. Why must you be careful of the roof when taking down a drill column?
48. Why are you forbidden to drill in old holes, or bootlegs?
49. Is dry drilling ever allowed?
50. What must be done at once with unused powder and caps?
51. Why is a miner forbidden to blast alone?
52. How is the working face valve left when blasting?
53. What must you be sure of before entering a place after blasting?
54. Name the important features of placing stulls in raises?
55. What must you always do before entering a raise?
56. After a raise is up 20 feet from last connection, how long a time must elapse before men can enter it again?
57. Why should blind raises upon their completion be examined closely?
58. Give the spacing of stulls and ladder platforms in long raises?
59. What position must the air hose be in when blasting?
60. In a two compartment raise, why should the chute be kept as full as practicable?
61. In a two compartment raise, when can the surplus muck be drawn off?
62. When is it compulsory to blast raises electrically?
63. What must you look out for in the muck pile?
64. Describe a well-kept muck pile?
65. Why do you examine the roof and sides of your working place?
66. Why should you never stand on loose dirt in a raise or chute?
67. How do you protect your hands, when pushing a car?
68. When dumping a car through the trap door of a chute, what must you do before leaving that chute?
69. Should a chute be drawn entirely empty?
70. When pushing cars over crossings, of what must you be sure?
71. Is it permissible to stand on top of a car, when loading from a chute?
72. Who can handle explosives?
73. How do you care for your carbide lamp when handling explosives?
74. How do you carry explosives from the magazines to the working face?
75. Describe the tools for opening powder boxes?
76. When is smoking forbidden underground?
77. What tool is used for charging a round of holes?
78. What special precaution must you take before setting off a blast?
79. After two faces come within 20 feet of each other what is the procedure in regard to making the connection, and in placing and releasing the guards when blasting? Who is responsible for guarding both faces?
80. How long must elapse after blasting before returning?
81. How do you fire missed holes?
82. Why do you use tamping?
83. Describe the standard method of making primers?
84. Can you ever blast without direct orders from your boss?
85. Describe the loading and blasting of a round when using fuse.
86. Describe the loading and wiring of a round when blasted electrically.

Mine Transportation

87. What equipment must a motor have on it, when it leaves the barn?
88. What is the duty of a train crew, when taking over a train?
89. How fast should a motorman run his train?
90. Is anybody allowed to ride a train besides the members of the train crew?
91. When can a brakeman run a motor on the main line?
92. In what sections of the train are train crews forbidden to ride?
93. Who is responsible for protecting the rear end of the train?
94. Are you allowed to get on or off the front end of a train that is in motion?
95. How does a brakeman make sure a switch is properly thrown?
96. What type of switching is forbidden?
97. Of what must a train crew be sure of, before they enter the main line?
98. Is it permissible to walk along side of a train when it is in motion?
99. What is the meaning of the following signals: 2 long blasts - 3 long blasts - 2 long 1 short 1 long.
100. Describe the block signals and their purpose.
101. When can a train be pushed on main line?
102. What is the rear end brakeman's duty, when a train is being pushed?
103. What trains have right of way in stoping areas?
104. What is a brakeman's standard equipment for pulling a chute?
105. Should a brakeman pull a chute when the doors or other equipment are in bad order?
106. What precautions must be taken when dumping cars at the pockets?
107. What must the train crews do before throwing in a circuit breaker?
108. What is the duty of the train crew upon leaving the loading area?
109. What is the first thing a motorman should do, when the power goes off, if his train is in motion?
110. What precaution must a motorman take when leaving his motor?
111. Give the regulations for coupling cars?
112. In uncoupling air brake cars, what is uncoupled first?
113. How are cars coupled at shaft stations?
114. Give rules for blasting hing up chutes?
115. How do you know when they are blasting on the grizzly level?
116. Describe the following lamp signals. Stop - Stop an approaching train - To move train towards you - To move train away from you.

Hoisting and Shaft-Repair Work

117. What do the following signals mean - One bell - two bells. Give the signals for blasting - danger, hoisting and lowering men.
118. Who is permitted in a hoistroom?
119. When a signal is not understood what must the engineer do?
120. When must the empty cage or skip be run through the shaft?
121. Can a skip or cage be moved without the proper signal?
122. When can a telephone clearance be accepted?
123. Under what condition can slack rope be taken up from cage or skip?
124. How should the engineer leave his cage or skip and hoist at quitting time?

125. Describe the use of engineers log book.
126. Can a cager signal one cage, while the other is in motion?
127. How should shaft gates and bars be kept?
128. Can both cagers be out of hearing distance of the call bell at the same time?
129. Is smoking or lighted lamps allowed on the cage?
130. Are men allowed to ride in the cage with supplies?
131. Give the rule on hand tools?
132. Give rule for handling powder on cages?
133. Who may signal the hoist engineer?
134. Who may ride a skip?
135. What precautions should be taken when throwing in chairs?
136. What is your first duty in connection with the hoisting engineer, before starting repair work in a shaft?
137. What should be the thickness of the timber used for working platforms in a shaft?
138. What portion of the shaft should be cleaned before starting repairs?
139. Can hoisting be carried on in the compartment undergoing repairs?
140. When changing skips or cages what precautions must be taken?
141. What must be done after doing any torch work in a shaft?
142. Before starting to work on the muck in the pockets, what precautions should you take?

Mechanical

143. When you discover a defective tool what must you do at once?
144. How are handles secured in sledges or hammers?
145. What must you be sure of before using a file?
146. What must you do before using a chain or rope to lift a heavy load?
147. Can you use a power tool without permission?
148. Of what must you be careful, when starting a fire in a forge?
149. When can you put on or take a belt off of a pulley?
150. Who is responsible for seeing that guards or protectors are in their proper places, when machinery is being used?
151. When should machinery be oiled?
152. Why is loose or baggy clothing prohibited around machinery?
153. When should machinery be cleaned?
154. How do you remove small material from a punch, when the power is on?
155. Should all drill work be clamped to the drill bed?
156. Give the rules on emery wheels?
157. What should you do before swinging a sledge?
158. What precaution should you take when cutting rivets?
159. What must you look out for, when using cranes?
160. Describe the proper way to use a ladder.
161. Name the important points in scaffold building,
162. Of what must you be careful, when using torches around inflammable material?
163. What is the object of using Danger or Caution signs?

Acetylene Welding and Cutting

164. Should you ever use oil around oxygen or acetylene?
165. Before connecting blow pipe, what must you do with the hose?
166. What is the color of oxygen hose? Acetylene?
167. How do you examine the hose for leaks?
168. Is there any time you might use a lighted blowpipe without goggles?
169. What precaution should you take when working in a confined space with blow torch?
170. What should be done with cylinder valves when cylinders are empty?
171. How should cylinders be cared for when in use?
172. What is the underground fire alarm?
173. What is the duty of the workmen when fire is discovered
174. What is the duty of bosses when fire is discovered?

OUTLINE OF FIRST-AID COURSE

Lesson 1

Value of First-Aid Training:

Valuable on and off the job.

Important to teach to family.

First aid teaches a person how to recognize and to treat arterial bleeding; to recognize and to treat shock; to realize the need of artificial respiration; to treat open wounds to prevent infection.

Shock:

Describe symptoms and causes. Explain treatment: Lower head; clean mouth; loosen clothing; keep warm, use blankets, hot pads, hot water bottles, etc.; rub extremities toward the body.

Stimulants, by nose when unconscious; by mouth when conscious. Place patient on floor and demonstrate treatment of shock.

Lesson 2

Arterial Bleeding:

Give circulation of blood.

How arterial bleeding is checked: by hand; locate pressure points; by tourniquets; pass out bandages, hard objects, and twisters to class, and put on all tourniquets.

Lesson 3

Artificial Respiration:

What it is and when needed.

Electric shock (rescue of victim).

Gas poisoning.

Drowning.

Demonstrate artificial respiration.

Make all get on floor and go through an actual practice.

Lesson 4

Carbon Monoxide:

Give the complete lecture and demonstrate self-rescuers.

Let class look the self-rescuers over both open and closed.

Improvise a stretcher. Test it.

Lesson 5

Open Wounds:

Three different kinds of wounds: Incised, lacerated, and punctured.

Those that do not bleed most dangerous.

What to do when receiving a scratch. Report to boss at once; report to station at end of shift.

Violation of rules not to report all wounds, scratches, burns, or slivers.

Demonstrate use of:

Mercurochrome, patches, and compress; put on two or three dressings to give general idea of application. (Where to place knots.)

Slings:

Demonstrate open and cravat.

Burns:

Exclude air and send to doctor.

If too far from hospital use picric acid gauze or salve.

Acid and caustic burns: Use water first to wash and dilute acid or caustic.

Lesson 6

Dislocations and Fractures:

What dislocations are.

Demonstrate reductions of jaw and finger.

Place in most comfortable position and send to doctor.

Fractures:

Simple and compound.

Caution against converting simple into compound.

Demonstrate simple fracture of leg; compound fracture of forearm (use splints and padding, tourniquet and compress).

Note:

Each day quickly review pressure points.